These, with the concise and illuminating descriptions in the text, should give any reader of ordinary intelligence a very fair idea of the marvellous discoveries of modern science regarding the things and movements around him.

WILLIAM E. ROLSTON.

RARE ELEMENTS.

Introduction to the Rarer Elements. By Dr. Phillip E. Browning. Second edition, thoroughly revised. Pp. x+207. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1908.) Price 6*s*. 6*d*. net.

DURING the last few years our knowledge of the chemistry and properties of the rarer elements has been largely developed, and the scientific and commercial interests connected with them having assumed considerable importance, the publication of a second edition of the above useful handbook is to be welcomed.

The scheme of the work remains the same as in the edition of 1903; with each element an account is given of its discovery, occurrence, extraction, properties, &c., concluding with more or less voluminous details of experimental research work. The revision has been very thorough; some matter dealing with supposed elementary substances, the existence of which has since proved more than doubtful, has been removed —for example, the so-called elements etherion, lucium, glaukodymium, &c. A chapter on radio-elements by Dr. B. B. Boltwood is included, and the section on rare earths has been largely increased, and much valuable matter added to it.

The description of niobium and tantalum has been brought up to date, and all that is known of the latter interesting and very valuable metal, with its chemistry and unique properties, is given. The gases of the atmosphere, argon, helium, krypton, neon, and xenon, with their history and properties, are described in detail, and several pages are devoted to an account of some of the technical applications of the rarer elements which greatly emphasises the importance of research among these practically unknown substances; the book concludes with a series of tables for the qualitative separation of the rarer elements.

Speaking generally, as might be expected from the repute and position of the author, the work is thoroughly practical and trustworthy, and is confined to a brief description of known facts, the author having wisely refrained almost completely from touching upon the huge mass of speculative matter that has unhappily been woven into this branch of chemistry; no mention is made of the alleged transmutation of copper into lithium by radium emanation, and no surmises are given of the results that may be expected to follow the production of so many pounds of radium, &c.; in fact, the brevity is carried to an extent that is almost to be regretted, but what is given is to the point. The chapter on the radio-active elements commences with a brief account of the discovery of radio-activity by M. Henri Becquerel, and of radium by P. and S. Curie and G. Bemont, with the properties of uranium, ionium, actinium, thorium, &c., and the section concludes with a table of radio-activities giving the "radiation emitted," "disintegration constant," and "half-value time period" for all the known radio-elements.

Much valuable matter has been added to the section on rare earths; a list is given of more than 170 rare-earth minerals, with the composition, percentage of yttria, ceria, thoria, and zirconia, so far as is known in each case; and in the portion dealing with the chemistry, a diagrammatic scheme for their separation is shown; this diagram is a novelty, and will be found a distinct help in elementary work on rare earths, but considering the obscurity that undoubtedly still surrounds the reactions of many of these bodies it can only be taken as suggestive.

It is much to be regretted that little or nothing is said about the spectra of these obscure bodies, particularly as it is by the study of their spectra that most of them have been recognised and isolated; the extremely characteristic spark spectra of yttrium, samarium, europium, ytterbium, scandium, and other elements are passed over without notice; when we take as only one instance the fact that the very rare element scandium can be directly detected in minerals containing it by a single observation, this is the more remarkable.

We may give as an instance of the present activity of research among the rare earths the fact that since this edition went to press the announcement has been made by G. Urbain and by Auer von Welsbach of the decomposition of ytterbium into two distinct substances.

It is a very great pity that the work has not been properly indexed; brevity in this direction is a decided disadvantage, and takes much from the usefulness of the work.

J. H. G.

A GENERAL HISTORY OF SCIENCE.

Aus der Werkstatt grosser Forscher. Allgemeinverständliche erläuterte Abschnitte aus den Werken hervorragender Naturforscher aller Volker und Zeiten. By Dr. Friedrich Dannemann. Dritte Auflage. Pp. xii+430. (Leipzig: W. Engelmann, 1908.) Price 6 marks.

DR. DANNEMANN'S book represents an attempt to trace the gradual growth of scientific knowledge by a superficial examination of critical epochs in which some new discovery has been made available or some truth apparent. It seems a very desirable, as it is a very pleasant, task to survey the whole history of natural science, to recall the men whose genius and achievements have widened the outlook, and given force and direction to new researches. Such a study may be pleasantly impressive and momentarily stimulating, but while it lacks in thoroughness and precision its educational value must be small. A student of a particular department of science should know, it is true, the successive stages by which that subject has advanced, and the author is quite justified in intimating that the study of the original memoirs in which the great masters have developed their results, in the language in which they have expressed themselves, is eminently calculated to present the

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clearest insight into the processes that have been employed and the reason for the direction which progress has taken. It is a long cry from the ancient Greek to the modern physicist, from Aristotle to Pasteur, and by a few scanty references to the work of eminent men in past centuries we do not get any continuous picture of the growth of any one science, be it physics or chemistry, zoology or botany, geology or astronomy, for all these and some others figure within the modest compass the author allows himself.

A comparison with Ostwald's "Klassiker der Exacten Wissenschaften" would be inevitable, even if the author had not frequently directed attention to that work, and occasionally availed himself of its contents. Such comparison is, however, to the disadvantage of the present work. In that case, the classics of science hitherto accessible only to the few were made available to the many. Specialists, each eminent in his own branch of science, were responsible for the presentation of the work, each in his own department, to which ample space was allotted. But here the only arrangement that can be recognised is roughly chronological, and the student is led from subject to subject without leisure to concentrate his attention upon any. Perhaps there is no great reason to quarrel with the choice of researches the author has made in order to illustrate particular phases in the history of discovery. No selection could be entirely satisfactory when there is overlapping of research or contemporaneous advance. Why, for example, should Torricelli be omitted and Guericke appear, or Celsius be chosen in preference to Reaumur? Sir William Herschel finds a place, Bradley does not; Chladni discusses the origin of meteors, Schiaparelli is passed over in silence. One might ask whether Humboldt and Goethe fairly come within this scheme, or whether Darwin is adequately represented by an extract from the "Journal of the *Beagle*," or Helmholtz by a quotation from a popular lecture? But it would be unfair not to remember and admit that this work is only a portion of a larger treatise. It is the first volume of a "Grundrisz einer Geschichte der Naturwissenschaften," and possibly if the whole treatise were before us the scheme could be better appreciated.

SANITARY SCIENCE.

The Essentials of Sanitary Science. By Gilbert E. Brooke. Pp. xii+413. (London: Henry Kimpton, 1909.) Price 6*s.* net.

THE author of this work states in his preface that he hopes it will meet its aim of covering all the necessary ground for the student preparing for the diploma of public health, and that he has endeavoured to make it as useful in the laboratory as in the study; furthermore, he hopes it may also be useful to sanitary officers and medical officers of the public services. A glance suffices to make it plain that he has not achieved his aim. He has failed because he attempted the impossible when he set himself the task of covering the whole range of the science and practice of hygiene and public health within the narrow compass of a small, handy volume. The work is, in fact, little more than a digest or summary, which is not suited to the student's needs, and the lack of detail is also an essential respect in which it will fail to meet the needs of the public-health official. It is not sufficient, for instance, to tell the student for the diploma of public health that in reference to the working of a barometer, corrections have to be made for capillarity, temperature, and altitude (p. 29), when his examiners expect him to know how these corrections are made; nor is it sufficient to offer a sanitary official, presumably for reference purposes, a digest of sanitary law in which the whole of the important and complicated subject of legislation dealing with the food supply is dismissed in a page and a half of printed matter.

Although the general scrappiness of the information so materially limits the value of the book to the student and practitioner alike, it possesses some good points which add to one's regret at having to criticise unfavourably the work as a whole. Little fault can be found with the selection made of the material dealt with. Indeed, for the most part it is wise and in good proportion; but a glaring exception to this rule is to be noted in the case of tuberculosis, which is not mentioned in the index, and is only referred to in connection with dust and milk in the text of the book. Again, there are few instances of inaccuracies —the faults of commission, in fact, sink into insignificance before the all-prevailing faults of omission; but an insufficient statement of the subject is often responsible for leading the student by implication to erroneous conceptions. In this connection the author's attention is directed to the fact that for the purpose of aërobic bacteriolysis it is not usual to put a layer of sand on the top of the filter and another layer at the bottom immediately over the effluent pipes; nor is the average composition of crude sewage in this country represented by albuminoid ammonia in the amount of 0·28 of a part per 100,000.

It is conceded that a vast amount of information is comprised within the small compass of the work, but it is information of a scrappy and incomplete order, and information in respect of which essentials, both from the standpoint of the student and practitioner, are omitted. As evidence of the justice of this statement it is not necessary to do more than direct the reader's attention to the fact that the bacteriological examination of water is dismissed in three and a half pages, or not much more than 100 lines of print; that to the chemical examination of disinfectants three-quarters of a page of printed matter is devoted, and carbolic acid is the only disinfectant dealt with; and that the important subject of school hygiene, the importance of which to the public-health student cannot well be exaggerated now that the Education (Administrative Provisions) Act is a force in the land, is dismissed in four pages.

Dr. G. E. Brooke has had experience both as a health officer and a teacher, and is the author of one or two useful handbooks, and he must realise that this work stands in need of a considerable extension if it is to meet the objects for which it was designed.

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